TG. CAB

SOUND LEVEL METER

G QUIRK

PLEASE DO NOT REMOVE FROM TEST EQUIPMENT LAB

THANK YOU

ROHDE & SCHWARZ

BESCHREIBUNG

Instruction Book

SOUND LEVEL METER

Type EZLT BN 4513

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Note: Always quote the Type and Order Number (BN) in addition to the Serial Number (FNr.) of the set when asking for technical information and, in particular, when ordering repair parts.

Edition R 7867/762

(Translation of the German edition 4513 A/662)

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1. Specifications

Frequency range	30 to 12,500 cps
Sound-level range	30 to 120 db above 0.0002 µbar
in 8 sub-ranges	30 - 50 db, 40 - 60 db, 50 - 70 db, 60 - 80 db, 70 - 90 db, 80 - 100 db, 90 - 110 db, 100 - 120 db
Frequency weighting, switch-selected	ISO curve A, ISO curve B, ISO curve C, flat
Accuracy	IEC standard specifications are met
Meter speed	fast or slow; IEC standard specifications are met
Microphone	electrostatic type
Calibration	against internal facility
Audio output I	600 Ω impedance, output voltage approx. -18 db across 600 Ω at f.s.d.
Audio output II	4 kΩ impedance, 2 v_{rms} across 100 kΩ at f.s.d.
Power supply	small storage batteries rechargeable from battery charger BN 4513-50
Battery charger, input switchable for	110 - 140 v and 140 - 250 v, 47 - 63 cps; 6 v DC and 12 v DC
Valves, etc.	2 small storage batteries R&S Stock No. Ba 30012 1 valve DF 703 5 transistors OC 603 1 transistor OC 604 spec.
Dimensions	tapering oblong case: approx. 75 x 85 x 305 mm
Weight	1 kg

Accessories

1 shoulder strap for Type EZLT

1 battery charger with 2-wire power cable and 1 cable with 5-pole connectors for connection of battery charger and Type EZLT.

1 plug R&S Stock No. FS 409/30 (for battery charger).

2. Uses

Although very small and light in weight, the Sound Level Meter Type EZLT offers all the features necessary for standard sound level measurements. Its high sensitivity, its three weighting curves A, B, and C, and its tolerances meeting standard specifications, ensure versatile application. It is suitable for measurement of weak noise, as encountered particularly in investigations of architectural acoustics, and for the most intense traffic noise. Easy and convenient to use, the Type EZLT permits rapid measurements also when held in hand. Due to the shape of the case, the sound field will not be disturbed by the observer. Two audio outputs allow connection of frequency indicators, tape recorders, or wave analyzers, etc. for special measuring purposes.

3. Operating Instructions

3.1 General

The three switches on the left-hand side of the instrument have the following positions:

Weighting switch

A	for measurements with weighting curve A, between 30 and 60 db
B	for measurements with weighting curve B, between 60 and 120 db
C	for measurements with weighting curve C (flat), between 30 and 120 db
E	for calibration (see section 3.5).

Range switch

40 50 60 70 80 90 100 110	Range switch values in db; setting of this switch + meter reading (-10 to 0 to +10) gives the measurement result in db

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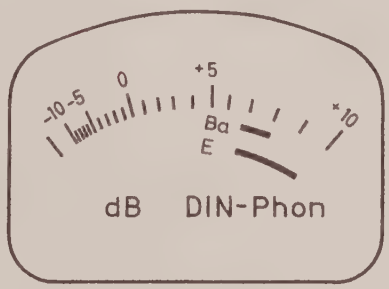
Function selector

T ▲	for measurement with slow meter speed. This position is non-locking; it is effective only as long as the switch is pressed in this position.
ON	for measurement with fast meter speed.
BA	for checking the built-in battery. The instrument should be operated and stored only with the battery sufficiently charged (see sections 3.3 and 4.).
OFF	The instrument is switched off in this position; no current is drawn from the battery. This position is used for battery charging (see section 4.) (max.45 ma)

Meter: The scale is calibrated -10 to 0 to +10 db and provided with two sections marked Ba and E, respectively. Ba serves to check the built-in battery, E to calibrate the set.

Meter scale



Below the meter is a 5-contact socket and a recessed knob. Either the battery charger BN 4513-50 or, for example, a tape recorder can be connected to the socket. The knob serves for calibration.

3.2 Setting the Mechanical Zero of the Meter

The function selector must be at OFF. Turn the slotted screw recessed below the meter until the pointer is at the mechanical zero. This is indicated by a mark a few millimetres to the left of the division -10. Be sure to make this adjustment in the position of the instrument in which it will be during the measurement. When the instrument is inclined, the zero position of the pointer may slightly change.

3.3 Checking the Battery

Turn the function selector to BA. The pointer deflection should then be within the section marked BA. If the pointer is at the left-hand end of this section, the battery must be recharged (see section 4); discharging

the battery further would diminish its storage capacity so that the almost unlimited life of the battery would be shortened. If the battery is always recharged in due time, an operation of 6 to 7 hours is ensured with the battery completely charged.

3.4 Setting Up

It should always be remembered that the sound level existing at the microphone depends not only on the intensity of and the distance from the sound source but also on the propagation conditions. Sound-reflecting surfaces near the instrument may severely affect the sound level, increasing or decreasing the sound pressure depending upon the phase relationship of the reflected sound waves. When the instrument is held in the hand during the measurement, the operator should not rest it against his body but rather keep it away as far as possible. Otherwise, reflected sound waves may cause a measurement error up to ± 5 db.

A more accurate and more comfortable method is to mount the instrument on a stable tripod. The operator can then stand beside the instrument to read the sound level and there is no risk of affecting the result by sound waves reflected from the operator's body. A 3/8" thread at the bottom of the instrument is for mounting to the tripod. Although the characteristic of the microphone is spherical, the instrument should always be oriented towards the sound source.

3.5 Calibration

Set the function selector to ON and the weighting switch to E. After about 30 seconds press the knob on the front, for example with the thumb of your right hand, and turn it so that the pointer of the meter comes temporarily within the scale section marked E.

This calibration adjusts the gain of the instrument to the nominal value and at the same time checks the microphone. The calibration remains constant for some time, unless the knob is turned, and need not be repeated before each measurement.

The calibration of the Sound Level Meter Type EZLT may also be made against an external standard source of sound, provided the distance to be kept between the microphone of the Type EZLT and the standard source of sound for a given calibration sound level is known.

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3.6 Measurements

3.6.1 The Quantities Measured

The sound pressure p is the periodic pressure fluctuation of the air at a given point, due to the sound. The unit is the microbar (μbar)

1 μbar = 1 dyne per square centimetre.

It roughly corresponds to one millionth of an atmosphere. A sound pressure of 1 μbar exists at about the centre of the pressure range of audible sound (0.0001 to 1000 μbar).

The sound intensity I is the sound energy transmitted in a progressive wave through an area of 1 square centimetre normal to the direction of propagation.

Sound pressures and sound intensities are compared by stating the logarithm to the base 10 of their ratios. The tenth part of the logarithm of the power ratio is called 1 decibel (db). Hence 1 db is also the twentieth part of the logarithm of the sound-pressure ratio. If I_1 and I_2 are two sound intensities, then the corresponding sound levels differ by $10 \log_{10} I_2/I_1$ (db); or given the sound pressures p_1 and p_2, the sound levels differ by $20 \log_{10} p_2/p_1$ (db). The logarithmic graduation in db roughly corresponds to the pressure discrimination of the ear.

By referring to a reference level of sound intensity $I_1 = I_0$ or sound pressure $p_1 = p_0$, the sound level can be given directly in db:

$$L = 10 \log_{10} I_2/I_1 \quad \text{or} \quad L = 20 \log_{10} p_2/p_1.$$

At the 1937 International Congress in Paris the reference level for a pure tone of 1000 cps was fixed at

$$I_o = 10^{-16} \text{ watt} \qquad \text{or} \qquad p_o = 2 \times 10^{-4} \text{ μbar.}$$

The calibration of the Type EZLT is referred to this value. This level roughly corresponds to the threshold of audibility at 1000 cps.

3.6.2 Sound-pressure Measurement

Set the function selector to ON and the weighting switch to C. Set the range switch to a position where the meter gives a deflection between 0 and +10. This is possible for sound pressures between 40 and 120 db. The scale range between -10 and 0 is used only for sound pressures lying between 30 and 40 db. The measured value in db is the sum of the value selected with the range switch and of the scale reading. If, for example, the switch is at 40 and the meter indicates -2, then the sound pressure at the microphone is 40 + (-2) = 38 db.

Note: The high-impedance electrostatic microphone, which is indispensable for this type of measurements, is matched to the amplifier proper by a valve (DF 703). For this reason care should be taken that the instrument case is not exposed to heavy vibrations or shocks. These might make the filament of the valve vibrate and cause a spurious voltage corresponding to a sound pressure up to 60 db. Such vibrations may occur, for example, when the instrument is mounted on a tripod and the ground is vibrating or when one of the switches is rapidly pushed against the stop. These vibrations of the filament can be suppressed in a simple way: just switch the instrument off for a short time. Thus the filament becomes taut and the vibrations disappear rapidly. This effect may be of particular importance in sound-pressure or sound-level measurements below about 60 db. In critical cases it will be necessary to hold the instrument in one's hand without vibration.

3.6.3 Sound-level Measurement

According to international recommendation the sound level may be measured with any weighting curve. But it is indispensable to indicate with which weighting curve the measurement has been made, otherwise the results are of no value. If the measurement has been made in switch position B (ISO curve B), then the measured value is designated as db_B; with the switch position A (ISO curve A) one obtains the result as db_A.

3.6.4 Meter Speed

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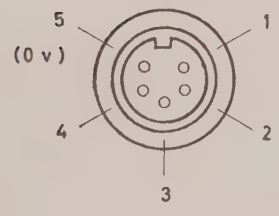
In the ON position of the function selector the meter speed is such that a sound pulse of 250 ms duration gives the same result within ± 0.5 db as a permanent tone of equal intensity.

For the measurement of heavily fluctuating sounds this meter speed is often too high. On the Sound Level Meter Type EZLT, therefore, the switch position T has been provided with a slow meter speed complying with the IEC recommendation. Here a sound pulse of 500 ms duration gives a result lower by 4 db than a permanent tone of equal intensity. The switch position T is non-locking; it is effective only as long as the switch is pressed in this position. If the switch is released it returns automatically to the ON position ordinarily used.

3.6.5 Connection of a Recorder

The 5-contact socket on the front (to the left below the meter) delivers two audio-frequency voltages for recording.

Front view of socket



Connections

1 - 5	Impedance 600 Ω, output voltage approx. 100 mv (-18 db) with 600 Ω load and full meter deflection.
4 - 5	Impedance approx. 4 kΩ, output voltage approx. 2 v rms (+8 db) with 100 kΩ load and full meter deflection
2 - 3	Input for DC voltage of approx. 2.5 v for charging of battery. Connect positive pole to 2, negative pole to 3. Function selector at OFF for charging, at BA for battery check.

A 600-Ω filter followed by an indicator may be connected to sockets 1 - 5 for noise analysis. Suitable filters and indicators of adequate sensitivity are available from R&S. The sockets 4 - 5 deliver an output of about 2 v across 100 kΩ and are suitable, for example, for connection of a tape recorder. A noise once recorded can then be repeated and analysed any number of times.

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The built-in miniature flange socket B has the R&S Stock No. FTD 60515. Mating plugs, FTS 60515, are available from R&S.

4. Charging the Built-in Battery

A fully charged battery permits operation for at least 6 hours. As mentioned in section 3.3, the battery should never be discharged so far that the pointer does no longer reach the scale section marked BA. Care should be taken that the battery is always recharged in time. Its life is then practically unlimited.

For recharging the battery, the battery charger BN 4513-50 is recommended. This charger may be connected either to an AC voltage of 110 to 250 v (47 to 63 cps) or to 6 or 12 v DC (e.g. a car battery).

Operation from AC supply: For 110 to 140 v AC, set the switch to 115 v, for 140 to 250 v AC to 220 v. Connect the battery charger to the AC supply using the two-wire power cable (R&S Stock No. 4513 - 50.9) supplied with the set. An on/off switch is not provided. The battery charger is on when the connection to the AC supply has been made. Connect the battery charger to the Type EZLT using the cable (R&S Stock No. 4513 - 50.8) fitted with two 5-pin plugs. The function selector of the Type EZLT must be at OFF. The charging time is about 14 hours. Check the charge with the function selector at BA. Discontinue charging when the pointer of the meter goes beyond the right-hand end of the scale section marked BA. If this is not the case, switch again to OFF and continue the charging process. When fully charged, the Type EZLT is ready to operate for 6 to 7 hours.

Operation from a 6-v or 12-v battery: A coaxial 9-mm socket (R&S Stock No. FD 409/30) is provided for connection of the battery charger to the battery. The mating plug (R&S Stock No. FS 409/30) without cable is supplied with the set. Connect the positive pole to the inner conductor and the negative pole to the outer conductor of the plug. Set the switch of the battery charger to 6 v or 12 v, depending on the battery voltage. Otherwise the charging procedure is the same as for operation from the AC supply.

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Replacement of the battery of the Type EZLT: If properly treated the two cells (DEAC) need not be replaced even after long service. Should the battery have been discharged so far that it lost its storage capacity, we recommend that you turn the set in to ROHDE & SCHWARZ München or to one of the branch offices.

5. Description (see circuit diagram)

The air-borne sound to be measured is picked up by the high-quality electrostatic microphone Mi1. Valve R81 transforms the high impedance of the microphone to a much lower value. It is followed by an amplifier using the five transistors T1 to T5. The gain can be varied in steps with switch S2, effective partly between R81 and T1, partly between T2 and T3, giving eight sound-level ranges. Switch S1 permits three different weighting networks to be connected into the circuit of this amplifier. A quasi rms-reading meter consisting of the germanium diodes G11-G12 and the 50-µa moving-coil meter I1 and calibrated in db serves to indicate the output voltage. The ganged switches S3 (function selector) and S4 permit selection of two meter speeds: In the ON position (where S_4 is still open) the meter speed is fast; if S3 is further advanced, S_4 closes and the meter speed decreases to 500 ms in accordance with the IEC recommendation. For connection of an external indicator or recorder the output voltage is either derived directly at the output transformer L3 and applied to contact 4 of the 5-pole socket, or applied via the voltage divider R43-R44-R45 to contact 1, the output impedance being 600 Ω.

Two gas-tight DEAC steel cells (1.25 v) connected in series and a voltage transformer using transistor T6 serve for power supply. In the BA position of S3 the charging condition of the two cells can be checked under normal load. The moving-coil meter with series resistor R78 should show a deflection within the scale section marked BA.

For calibration of the set (without external standard source of sound) switch S1 should be set at E; thus a feedback path is established from the output of the amplifier via C37-C38-C25-C24-Mi1 to the input of R81 so that the complete amplifier is excited and oscillates. The output voltage is indicated on the meter. If the meter deflection is within the scale section marked E, the gain corresponds to the nominal value. Otherwise the control R40 accessible at the front of the instrument should be adjusted accordingly.

Battery charger BN 4513 - 50: See separate circuit diagram. This set serves for recharging the two cells. It may be connected to the AC supply or to a car battery. In AC supply operation the transformer Tr1 and rectifier Gl1 are effective. The primary side of the transformer is not provided with a tap for the optional AC supply voltages of 115 v or 220 v, as frequently used in sets of this kind, but with series impedances in the form of capacitors. For 220 v, C2 + C3 are in circuit, while for 115 v capacitor C1 is in parallel to this combination via switch S1. During charging, only R4 is connected between Gl1 and Ba1 + Ba2. Cable K2, fitted with two 5-pin plugs, ensures correct polarity of the connection. When Ba1 + Ba2 are charged from a car battery, they are via S1 in series with resistor R2 at 6 v and additionally with resistor R3 at 12 v. K2 ensures again correct polarity of the connection between the battery charger and Ba1 + Ba2. A coaxial 9-mm socket is provided for connection of the battery. The positive pole must be connected to the inner conductor and the negative pole to the outer conductor.

Guarantee

Rohde & Schwarz guarantee

F O R O N E Y E A R

each instrument manufactured and sold by them to be free from defects in material and workmanship, subject to clause 5 of their terms of delivery and payment.

This guarantee does not imply the right to rescind a sale or demand a reduction in purchase price. The firm's obligation under this guarantee is limited to the repair or replacement of the defective part or parts, provided the claim is asserted in writing immediately, or within one week at the latest, after discovery of the defect. The part or parts shall be returned to the factory, with transportation charges prepaid, within one week from the instruction by the firm to do so. The return charges shall likewise be covered by the purchaser. The firm does not assume any liability for damage resulting directly or indirectly from the defect. The guarantee shall be void if the part or parts have been tampered with.

The seals of the instrument shall be undamaged. Rohde & Schwarz guarantee valves for which the purchaser has not received the certificate of guarantee of the manufacturer. Defective valves which are held to be covered by this guarantee shall be returned to the factory for examination. The following details shall be specified:

Number, date and reference of the invoice;

type and serial number (FNr.) of the instrument;

specification of valve defect.

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Table of Replaceable Parts for Type EZLT

Ref. No.	Designation	Ratings	R&S Stock No.
Ba1	Battery, small storage	1.25 v	Ba 30013
Ba2	Battery, small storage	1.25 v	Ba 30013
C1	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C2	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C3	Capacitor, electrolytic, tantalum	240 µf/10 v	2 x CEU 30443/ 120 parallel
C4	Capacitor, electrolytic, tantalum	10 µf/20 v	CEU 36343/10
C5	Capacitor, electrolytic	5 µf/25 v	CED 7/5/25
C6	Capacitor, electrolytic	5 µf/25 v	CED 7/5/25
C7	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C8	Capacitor, electrolytic	5 µf/25 v	CED 7/5/25
C9	Capacitor, electrolytic	10 µf/12 v	CED 7/10/12
C10	Capacitor, synth. foil	1000 pf/125 v	CKD 2/1000/125
C11	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C12	Capacitor, electrolytic	5 µf/25 v	CED 7/5/25
C13	Capacitor, electrolytic, tantalum	33 µf/10 v	CEU 30343/33
C14	Capacitor, electrolytic, tantalum	120 µf/10 v	CEU 30443/120
C15	Capacitor, electrolytic	5 µf/25 v	CED 7/5/25
C16	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C17	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C18	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C20	Capacitor, electrolytic, tantalum	10 µf/20 v	CEU 36343/10

Ref. No.	Designation	Ratings	R&S Stock No.
C21	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C22	Capacitor, electrolytic, tantalum	10 µf/20 v	CEU 36343/10
C23	Capacitor, electrolytic, tantalum	10 µf/20 v	CEU 36343/10
C24	Capacitor, synth. foil	0.47 µf/160 v	4513-3.1.3.
C26	Capacitor, paper	10,000 pf/250 v	CPK 10 000/250
C29	Capacitor, synth. foil	50,000 pf/250 v	4513-25
C30	Capacitor, lacquer-type	0.1 µf/60 v	CKL 2/0,1/60
C31	Capacitor, lacquer-type	0.1 µf/60 v	CKL 2/0,1/60
C32	Capacitor, synth. foil	50,000 pf/250 v	4513-25
C34	Capacitor, lacquer-type	0.25 µf/60 v	4513-27
C35	Capacitor, lacquer-type	0.1 µf/60 v	CKL 2/0,1/60
C36	Capacitor, synth. foil	400 pf/125 v	CKD 2/400/125
C37	Capacitor, synth. foil	80 pf/125 v	CKD 1/80/125
C38	Trimmer, disc	15 to 45 pf	CV 9135
C39	Capacitor, lacquer-type	2 µf/60 v	CKL 2/2/60
C40	Capacitor, lacquer-type	0.1 µf/60 v	CKL 2/0,1/60
C41	Capacitor, electrolytic	10 µf/12 v	CED 7/10/12
C42	Capacitor, electrolytic	100 µf/3 v	CED 3/100/3
C43	Capacitor, electrolytic, tantalum	100 µf/15 v	CED 3/100/15
C44	Capacitor, electrolytic, tantalum	100 µf/15 v	CED 3/100/15
C46	Capacitor, synth. foil	500 pf/125 v	CKD 2/500/125
C47	Capacitor, synth. foil	0.22 µf/160 v	CKG 54133/220
C49	Capacitor, electrolytic, tantalum	47 µf/6 v	4513-28

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Ref. No.	Designation	Ratings	R&S Stock No.
C50	Capacitor, electrolytic, tantalum	2.2 µf/20 v	CEU 36243/2,2
G11	Rectifier, germanium		GK/OA 95
G12	Rectifier, germanium		GK/OA 95
G13	Diode, silicon		GK/OA 129 a
G14	Diode, silicon		GK/OA 130
I1	Ammeter, moving-coil	50 µa	IPV 232/50 µa with scale according to 4513-22
L1	Choke		4513 - 5.11
L2	Choke		4513 - 5.12
L3	Choke		4513 - 4.10
Mi1	Capsule (microphone), capacitor		4502 - 40.4
R1	Resistor, depos. carbon	300 MΩ/0.5 w	WFS 3/300 M/0,5
R2	Resistor, depos. carbon	30 kΩ/0.05 w	WF 30 k/0,05
R3	Resistor, depos. carbon	60 Ω/0.05 w	WF 60/0,05
R4	Resistor, depos. carbon	60 Ω/0.05 w	WF 60/0,05
R5	Resistor, depos. carbon	60 kΩ/0.05 w	WF 60 k/0,05
R6	Resistor, depos. carbon	14.2 kΩ±1%/0.05 w	WF 14,2 k/1/0,05
R7	Resistor, depos. carbon	20 kΩ/0.05 w	WF 20 k/0,05
R8	Thermistor	20 kΩ	WHD 232/20 k/10
R9	Resistor, depos. carbon	50 kΩ/0.05 w	WF 50 k/0,05
R10	Resistor, depos. carbon	160 Ω/0.05 w	WF 160/0,05
R11	Resistor, depos. carbon	60 Ω/0.05 w	WF 60/0,05
R12	Resistor, depos. carbon	5 kΩ/0.05 w	WF 5 k/0,05

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Ref. No.	Designation	Ratings	R&S Stock No.
R13	Resistor, depos. carbon	40 kΩ/0.05 w	WF 40 k/0,05
R14	Resistor, depos. carbon	20 kΩ/0.05 w	WF 20 k/0,05
R15	Resistor, depos. carbon	10 kΩ/0.05 w	WF 10 k/0,05
R16	Resistor, depos. carbon	20 kΩ/0.05 w	WF 20 k/0,05
R17	Thermistor	20 kΩ	WHD 232/20 k/10
R18	Resistor, depos. carbon	50 kΩ/0.05 w	WF 50 k/0,05
R19	Resistor, depos. carbon	5 kΩ/0.05 w	WF 5 k/0,05
R20	Resistor, depos. carbon	10 kΩ/0.05 w	WF 10 k/0,05
R21	Resistor, depos. carbon	25 kΩ/0.05 w	WF 25 k/0,05
R22	Thermistor	20 kΩ	WHD 232/20 k/10
R23	Resistor, depos. carbon	8 kΩ/0.05 w	WF 8 k/0,05
R24	Resistor, depos. carbon	8 kΩ/0.05 w	WF 8 k/0,05
R25	Resistor, depos. carbon	10 kΩ/0.05 w	WF 10 k/0,05
R26	Resistor, depos. carbon	60 Ω/0.05 w	WF 60/0,05
R27	Resistor, depos. carbon	1 kΩ/0.05 w	WF 1 k/0,05
R28	Resistor, depos. carbon	5 kΩ/0.05 w	WF 5 k/0,05
R29	Resistor, depos. carbon	50 kΩ/0.05 w	WF 50 k/0,05
R30	Resistor, depos. carbon	1.6 kΩ/0.05 w	WF 1,6 k/0,05
R31	Resistor, depos. carbon	10 kΩ/0.05 w	WF 10 k/0,05
R32	Resistor, depos. carbon	25 kΩ/0.05 w	WF 25 k/0,05
R33	Resistor, depos. carbon	40 kΩ/0.05 w	WF 40 k/0,05
R35	Thermistor	10 kΩ	WHD 232/10 k/10
R36	Resistor, depos. carbon	10 kΩ/0.05 w	WF 10 k/0,05
R37	Resistor, depos. carbon	1.6 kΩ/0.05 w	WF 1,6 k/0,05
R38	Resistor, depos. carbon	25 kΩ/0.05 w	WF 25 k/0,05
R39	Resistor, depos. carbon	30 Ω/0.05 w	WF 30/0,05

Ref. No.	Designation	Ratings	R&S Stock No.
R40	Resistor, wire-wound, variable	100 Ω lin.	WR 1/100
R41	Resistor, depos. carbon	2 kΩ/0.05 w	WF 2 k/0,05
R42	Resistor, depos. carbon	6 kΩ/0.05 w	WF 6 k/0,05
R43	Resistor, depos. carbon	6 kΩ/0.05 w	WF 6 k/0,05
R44	Resistor, depos. carbon	1 kΩ/0.05 w	WF 1 k/0,05
R45	Resistor, depos. carbon	2 kΩ/0.05 w	WF 2 k/0,05
R51	Resistor, depos. carbon	10 MΩ/0.25 w	WF 10 M/0,25
R52	Resistor, depos. carbon	4 kΩ/0.05 w	WF 4 k/0,05
R53	Resistor, depos. carbon	1 kΩ/0.05 w	WF 1 k/0,05
R54	Resistor, depos. carbon	500 Ω/0.05 w	WF 500/0,05
R59	Resistor, depos. carbon	28.5 kΩ±1%/0.1 w	WF 28,5 k/1/0,1
R60	Resistor, depos. carbon	19.2 kΩ±1%/0.1 w	WF 19,2 k/1/0,1
R61	Resistor, depos. carbon	28.5 kΩ±1%/0.1 w	WF 28,5 k/1/0,1
R62	Resistor, depos. carbon	19.2 kΩ±1%/0.1 w	WF 19,2 k/1/0,1
R63	Resistor, depos. carbon	28.5 kΩ±1%/0.1 w	WF 28,5 k/1/0,1
R64	Resistor, depos. carbon	19.2 kΩ±1%/0.1 w	WF 19,2 k/1/0,1
R65	Resistor, depos. carbon	28.5 kΩ±1%/0.1 w	WF 28,5 k/1/0,1
R66	Resistor, depos. carbon	13.2 kΩ±1%/0.1 w	WF 13,2 k/1/0,1
R67	Resistor, depos. carbon	8.55 kΩ±1%/0.1 w	WF 8,55 k/1/0,1
R68	Resistor, depos. carbon	5.8 kΩ±1%/0.1 w	WF 5,8 k/1/0,1
R69	Resistor, depos. carbon	8.55 kΩ±1%/0.1 w	WF 8,55 k/1/0,1
R70	Resistor, depos. carbon	5.8 kΩ±1%/0.1 w	WF 5,8 k/1/0,1
R71	Resistor, depos. carbon	8.55 kΩ±1%/0.1 w	WF 8,55 k/1/0,1
R72	Resistor, depos. carbon	4.1 kΩ±1%/0.1 w	WF 4,1 k/1/0,1
R73	Resistor, depos. carbon	600 Ω/0.05 w	WF 600/0,05
R74	Resistor, depos. carbon	800 Ω/0.05 w	WF 800/0,05

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Ref. No.	Designation	Ratings	R&S Stock No.
R75	Resistor, depos. carbon	3 MΩ/0.1 w	WF 3 M/0,1
R76	Resistor, depos. carbon	20 kΩ/0.05 w	WF 20 k/0,05
R77	Resistor, depos. carbon	6 kΩ/0.05 w	WF 6 k/0,05
R78	Resistor, depos. carbon	60 kΩ±1%/0.05 w	WF 60 k/1/0,05
R80	Resistor, depos. carbon	160 Ω/0.05 w	WF 160/0,05
R81	Resistor, depos. carbon	250 Ω/0.05 w	WF 250/0,05
R83	Resistor, depos. carbon	4 kΩ/0.05 w	WF 4 k/0,05
Rö1	Pentode		DF 703
S1	Switch (weighting)		incl. in 4513-3
S2	Switch, range		incl. in 4513-3
S3	Function selector		incl. in 4513-3
S4	Switch, micro		SR/1 SM 1
T1	Transistor		GT/OC 603
T2	Transistor		GT/OC 603
T3	Transistor		GT/OC 603
T4	Transistor		GT/OC 603
T5	Transistor		GT/OC 603
T6	Transistor		GT/OC 604 spec.
Tr1	Transformer		4513 - 5.10

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Table of Replaceable Parts for Battery Charger BN 4513 - 50

Ref. No.	Designation	Ratings	R&S Stock No.
C1	Capacitor, MP	0.25 µf/500 v	CMR 0,25/500
C2	Capacitor, MP	0.25 µf/500 v	CMR 0,25/500
C3	Capacitor, paper	100,000 pf/400 v	CPK 100 000/400
C4	Capacitor, lacquer-type	2 µf/60 v	CKL 2/2/60
G11	Rectifier	20 v/110 ma	GNB 35/20/110
K1	Cable, power		4513 - 50.9
K2	Patch cord		4513 - 50.8
R1	Resistor, depos. carbon	1 MΩ/0.1 w	WF 1 M/0,1
R2	Resistor, depos. carbon	125 Ω/0.05 w	WF 125/0,05
R3	Resistor, depos. carbon	200 Ω/0.05 w	WF 200/0,05
R4	Resistor, depos. carbon	20 Ω/0.1 w	WF 20/0,1
S1	Switch		incl. in 4513 - 50.7
Tr1	Transformer		4513 - 50.6.4

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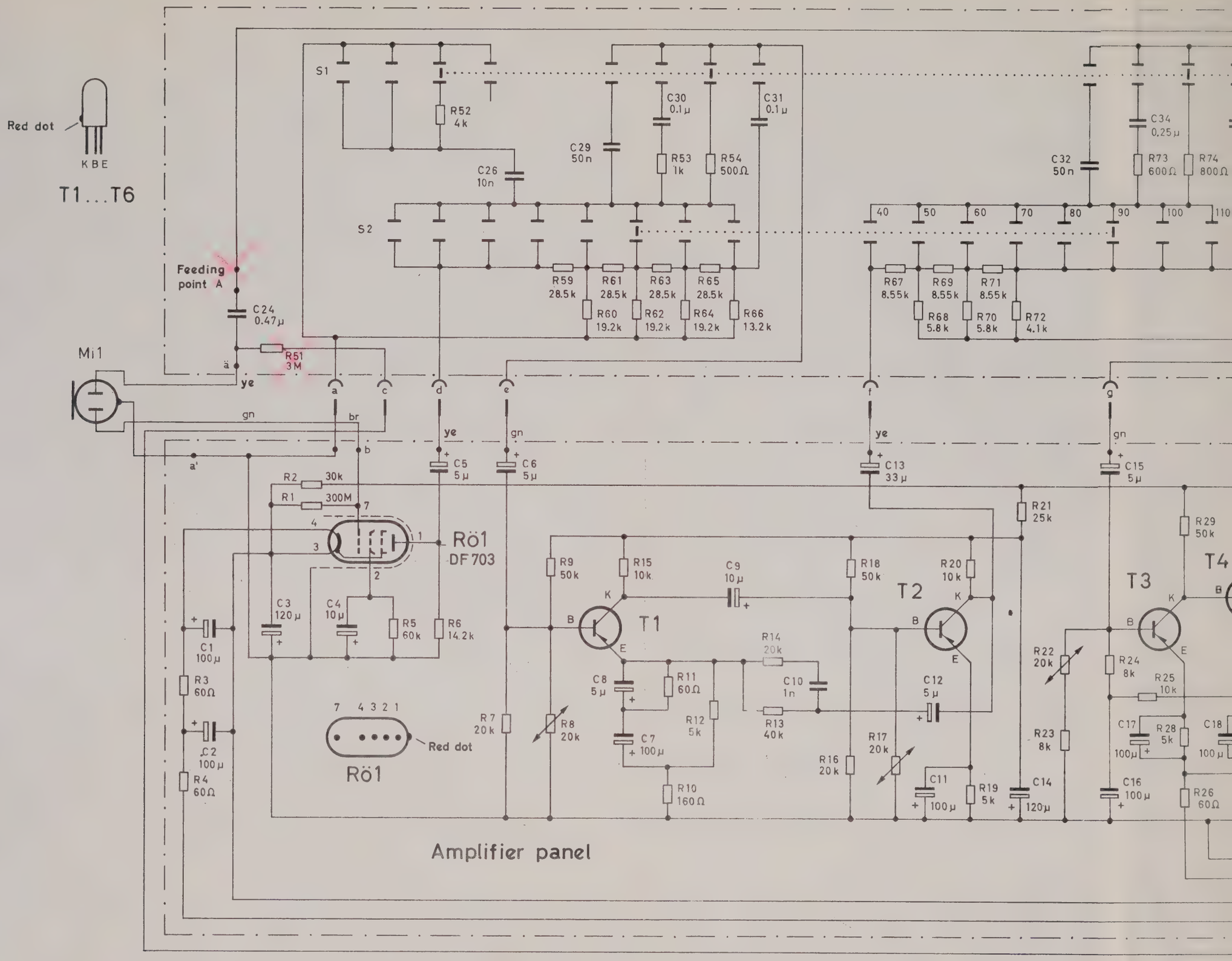


NOTE – The FEEDING POINT A is not located above C 24 as indicated but below C 24. The resistance of R 51 is 10 MΩ and not 3 MΩ. The value of the capacitors C 43 and C 44 is not 68 µf but 100 µf each. The capacitor C 45 has been omitted.

Switch panel

A B C E

C35 0.1µ

R75 3M

C36 400p

C37 80p

C38 45p

S4

C49 47µ

C50 2.2µ

C39 2µ

R76 20k

R77 6k

R78 60k

On Ba Off

S3

Bu1 St1

z gr

I1 +

y wh

x wh

Ba1

w gr

Ba2 +

h i j k t ß u v

br ye gn

18V~

l m n Bu2 St2

R32 25k

R38 25k

R42 6k

R43 6k

C20 10µ

C22 10µ

T5

Gl1

R44 1k

R45 2k

L3

C23 10µ

R33 40k

R37 1,6k

C21 100µ

R41 2k

R31 10k

R27 1k

R35 10k

R36 10k

R39 30Ω

Gl2

rd Bu2 St2

o

br p

ye q

A

R40 100Ω

2,5V r

s

5 ⊥

4 ~

3 —B

2 + B

1 ~ 600Ω

br T

gn

wh

gr

ye

⊥

Battery charger BN 4513-50

~ —

T6

C40 0.1µ

R80 160Ω

R81 250Ω

L1

C41 10µ

R83 4k

C42 100µ

wh u

gr t

gn r

ye s

ye c

ye l

br o

0V

Gl4

Tr1

C46 500p

L2

Gl3

C47 0.22µ

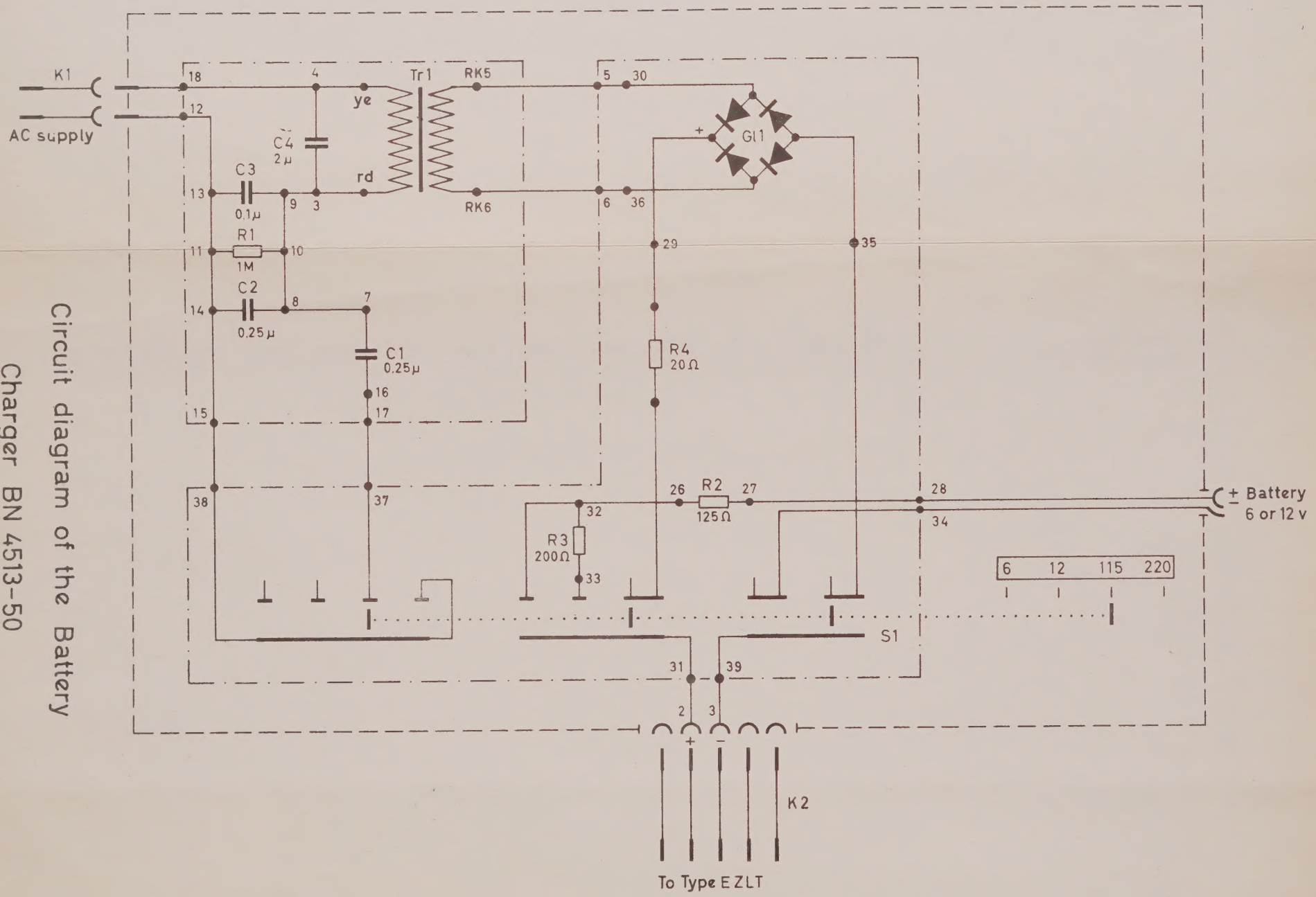
C44 + 68µ

C43 + 68µ

C45 160p

Voltage transformer panel

CIRCUIT DIAGRAM of the TYPE EZLT



Circuit diagram of the Battery Charger BN 4513-50

MP MASTER
MA23783